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Regional Sediment Management (RSM) Assessment of Longboat Pass, Manatee County, FL

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PURPOSE: This Coastal and Hydraulics Engineering Technical Note (CHETN) describes the history of ebb shoal morphology at Longboat Pass, Manatee County, FL, based on a review of the history and the recent inlet management studies for proposed navigational dredging of the Pass. The study area is located on the southwest Gulf of Mexico coast of Florida (Figure 1). The goals of the study were to determine the best channel configuration for navigation and most appropriate beneficial use of dredged sediments (the primary criteria used to evaluate channel alternatives).

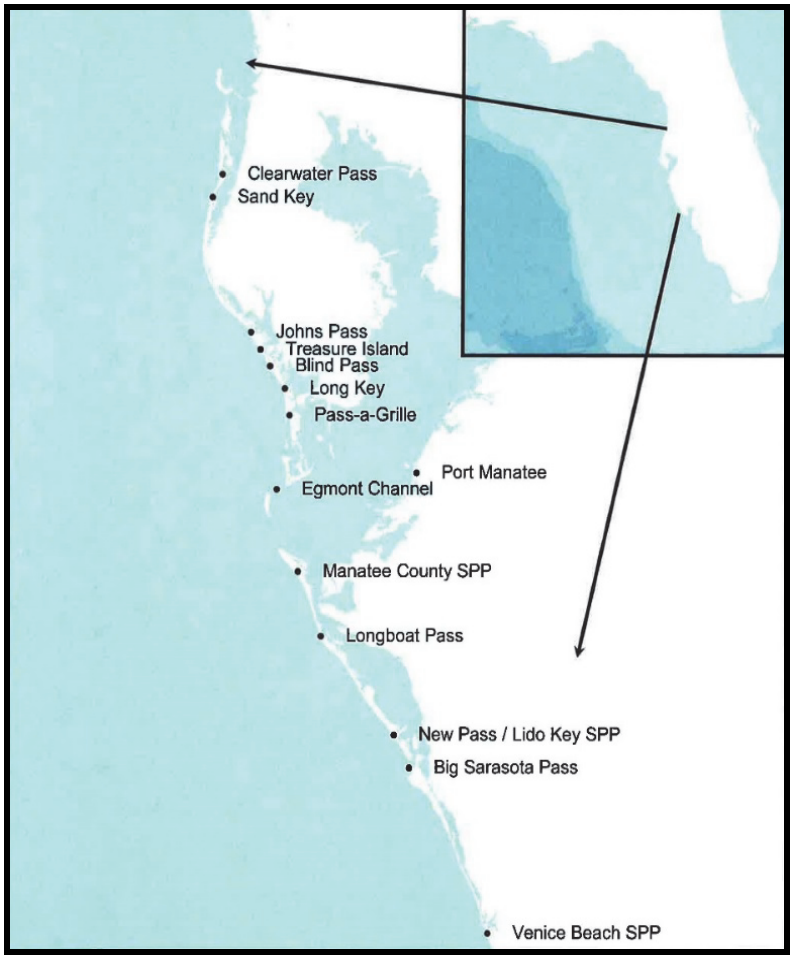

Figure 1. Active U.S. Army Corps of Engineers (USACE), Jacksonville District (SAJ), projects in Pinellas, Manatee, and Sarasota Counties, FL.

INTRODUCTION: Longboat Pass (Figure 2) is a Federal navigation inlet authorized in 1975. The navigation inlet was constructed in 1977. There are two Federal shore protection projects near Longboat Pass: (1) Manatee County Shore Protection Project (MCSPP) serving Anna Maria Island to the north and (2) Sarasota County Shore Protection Project–Longboat Key Segment (SCSPP-LK) serving Longboat Key to the south (Figure 2). This CHETN, funded by the U.S. Army Corps of Engineers (USACE), Regional Sediment Management (RSM) Program, is the result of a review by the USACE Jacksonville District (SAJ) of the history of Longboat Pass and the recent inlet management studies for proposed navigational dredging of Longboat Pass in Fiscal Year 2015.

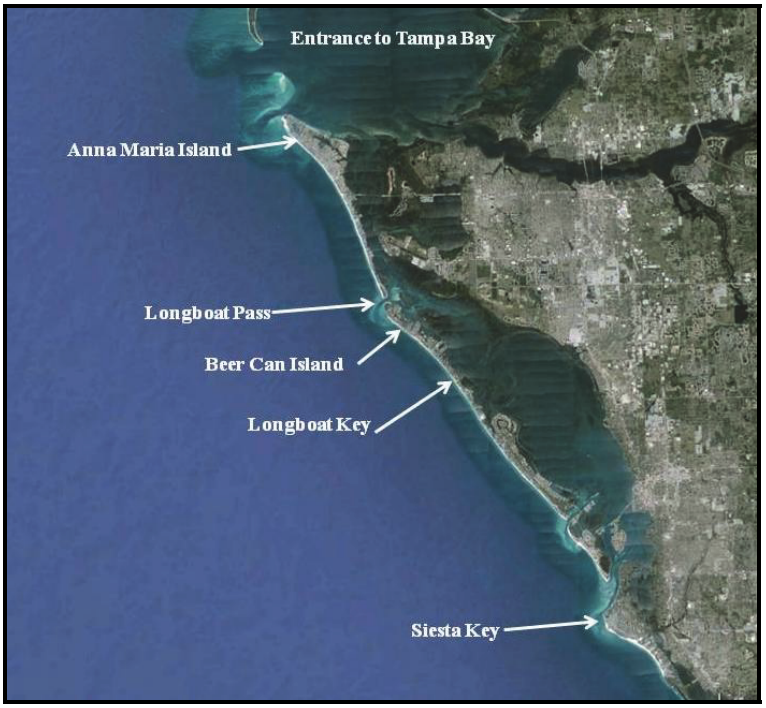

Figure 2. Longboat Pass, FL, and Longboat Key segment of Sarasota County Shore Protection Project (SCSPP-LK).

The Florida Department of Environmental Protection (FDEP) and the Gulf of Mexico West Coast Inland Navigation District previously funded Humiston & Moore Engineers (2008) to study the morphologic history of the Longboat Pass and its characteristics for developing inlet management strategies. The 2008 report titled *Regional Model for Sarasota Bay, and Case Studies of Longboat Pass and Venice Inlet* documents the natural and anthropogenic changes to the inlet system, including morphologic and hydrodynamic evolution. Additionally, Manatee County and the Town of Longboat Key funded Coastal Planning & Engineering (2011) (now CBI Industries, Inc.) to perform an inlet management study for Longboat Pass. That report titled *Inlet Management Study of Longboat Pass and Adjacent Beaches* was completed in 2011 and proposes a combination of structures and channel dredging to maintain navigation as well as to provide nourishment for adjacent beaches.

Longboat Key is presently experiencing erosion of the shoreline immediately south of Longboat Pass (Figure 2). The Town Commission of Longboat Key has expressed concern that the erosion on northern Longboat Key is due to the southerly migration of the channel at Longboat Pass and that the erosion may continue if the Federal channel alignment is changed to follow the natural channel (Manatee County 2010). In regard to navigation maintenance of the Pass, Humiston & Moore Engineers (2008) suggested dredging the Federal channel to mimic the present natural alignment as opposed to the previously maintained alignment and placing the dredged sediment on Longboat Key where the erosion is occurring. Coastal Planning & Engineering (2011) suggested dredging the Federal channel following the Authorized Channel configuration, and placing sediment on Longboat Key in conjunction with coastal structures to maintain the beach adjacent to the Pass.

The Authorized Channel design includes a 12 ft deep, 150 ft wide channel from the Gulf of Mexico to the bridge at Longboat Pass, and a 10 ft deep, 100 ft wide channel from the bridge to the intersection with the Gulf Intracoastal Waterway. The initial dredging of the inlet removed 300,000 cubic yards (yd^3) from the channel. Four other maintenance dredging events took place in 1981, 1985, 1991, and 1997, where 165,000, 150,000, 200,000, and 150,000 yd^3, respectively, were removed from the area (Humiston & Moore Engineers 2008).

Presently, both Anna Maria Island and Longboat Key have authorized Federal shore protection projects. The Anna Maria Island project is known as the Manatee County Shore Protection Project (MCSPP). The SCSPP-LK nourishment project includes a small portion of southern Manatee County. As of 2014, this project had never been constructed using Federal funds. Local interests have funded several nourishments along various portions of Longboat Key. The most significant event occurred in 1993 where over 3 million yd^3 were placed along the island using both Longboat Pass and New Pass channels as sand sources. Other large-scale nourishments include 891,000 yd^3 placed in 1997 and 1.5 million yd^3 placed in 2006. These projects utilized offshore borrow areas. Periodic maintenance dredging of Longboat Pass and New Pass provided sediment for small-scale nourishment projects along Longboat Key (FDEP 2008).

The earliest monitoring of Longboat Pass began with an 1886 hydrographic survey of the area. Both the USACE (1975) and Humiston & Moore Engineers (2008) documents indicate that, prior to development of the area, the inlet-barrier island system was highly dynamic. Changes in inlet location and configuration were common, including alternate inlet openings and closings. Early modification of the inlet began in the 1950s. Prior to Federal participation, local interests dredged the inlet in 1951 and 1959. Additionally, a jetty was constructed on the north side of the inlet in 1957 to support the bridge that connects the barrier island to the north (Anna Maria Island) with the island to the south (Longboat Key). The jetty stabilized the north side of the inlet, but the sand spit south of the inlet known as Beer Can Island continues to evolve (Figure 2).

In the early 1960s, a breach formed between Beer Can Island and Longboat Key, but the opening eventually closed, and Beer Can Island reattached to Longboat Key by 1969. To support shore protection efforts on Longboat Key, the well-developed ebb shoal complex was mined for sediment in 1993. Approximately 2 million yd^3 were taken from the outer ebb shoal lobe and placed on Longboat Key (Humiston & Moore Engineers 2008). Survey records show that an additional 300,000 yd^3 were taken from the northern portion of the ebb shoal adjacent to the inlet

channel, but documentation on the placement is not available. The dredging events interrupted the established quasiequilibrium of the system, resulting in changes to the inlet characteristics.

Today, the Federal navigation Authorized Channel at Longboat Pass has not been maintained following the original design layout. The ebb shoal has migrated to the south and has shoaled in much of the design channel, and as a result, the natural channel has also migrated to the south. Additionally, the channel orientation at the inlet throat has migrated to the south instead of the previous east-west alignment. Project authorization dictates that the entrance channel should be maintained at a depth of 12 ft and a width of 150 ft and that the interior channel that connects to the Intracoastal Waterway should be maintained at a depth of 10 ft and a width of 100 ft. The authorization at Longboat Pass does not specify either a given location of the channel or an orientation, so modification of the present (straight) Federal channel alignment to follow the natural channel alignment (dog-leg alternative) would not require a Post Authorization change (USACE 1975).

METHOD: SAJ has examined the most recent evolution of Longboat Pass using information gathered from available sources including lidar data, beach profile surveys conducted by USACE and Coastal Planning and Engineering, hydrographic surveys, and aerial photography. Data were analyzed within a geographic information system (GIS) framework to understand ebb shoal morphology and morphologic change within the most recent decade, with the goals of determining the best channel configuration for navigation and for beneficial use of dredged sediments (the two primary criteria used to evaluate the channel alternatives).

RESULTS:

Historical and present ebb shoal planform. The 1950 ebb shoal planform had a very large northern lobe before the construction of the jetty at the southern end of Anna Maria Island and the bascule bridge over Longboat Pass in 1957 (Figure 3). The 1989 ebb shoal planform depicted the time period after the initial dredging of the Federal channel in 1977 and after navigation maintenance dredging in 1981 and 1985. The northern lobe of the ebb shoal generally followed the limits of the authorized Federal channel; however, the distal portion of the northern lobe intersected the mouth of the channel. The 1998 ebb shoal configuration depicted the evolution of the ebb shoal after the removal of 2.3 million yd^3 of sediment from the shoal in 1993. Figure 4 shows the ebb shoal configuration in 2010 and 2014. The authorized (straight) Federal channel delineation completely bisected the northern lobe of the ebb shoal, and the northern lobe of the shoal was encroaching on the dog-leg alternative channel configuration. The dog-leg alternative channel configuration was evaluated because it more closely followed best navigable water in 2010.

Pass and shoal migration. The evolution of Longboat Pass between 2003 and 2014 is shown in Figures 5–8. In 2003, the northern lobe of the ebb shoal was starting to intersect and shoal into the Authorized Channel at its distal end to the southwest. In general, the channel still followed the alignment of the Authorized Channel but was starting to shoal from the north (Figure 5). By 2008, the northern lobe of the ebb shoal was encroaching into the Authorized Channel (Figure 6), and the southern lobe of the ebb shoal had migrated to the south. In 2010 (Figure 7), the northern lobe of the ebb shoal had migrated across the Authorized Channel completely, and by 2014 (Figure 8), the most distal portion of the north lobe of the ebb shoal is shoaling into the template of the alternative channel.

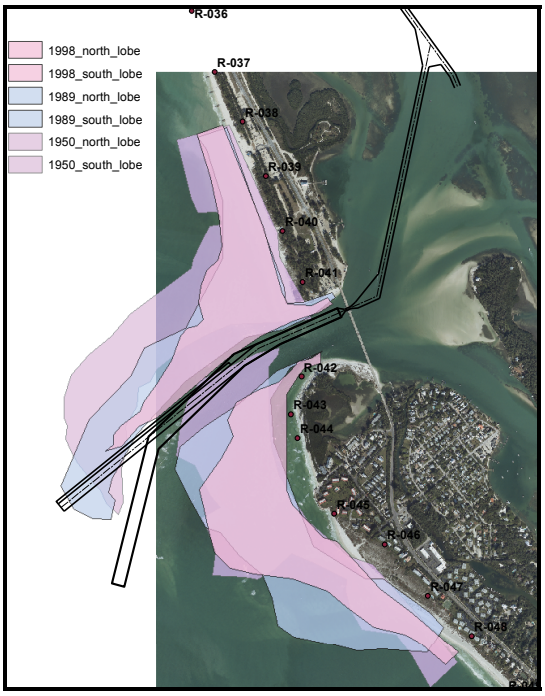

Figure 3. Longboat Pass ebb shoal planform during years 1950, 1989, and 1998. Aerial taken in 2014. Authorized Channel (straight). Alternative channel (dog leg).

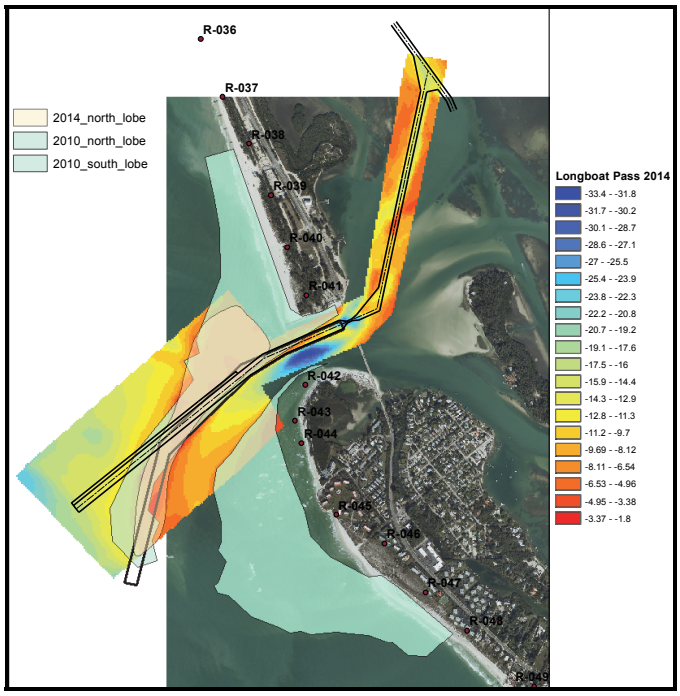

Figure 4. Longboat Pass ebb shoal planform during years 2010 and 2014. Bathymetry obtained in 2014. Aerial taken in 2014. Authorized Channel (straight). Alternative channel (dog leg).

Natural sand bypassing. Between 1993 and 1998, inlet morphology adjusted to re-establish bypassing after dredging in 1993 and formed a smaller bypassing and attachment bar than had been present under pre-1993 dredging conditions. From examination of the bathymetric change from 2003–2008 (Figure 9), it can be seen that the attachment bar was located between survey Range 46 (R-46) and R-47. Bathymetric change between 2003 and 2010 (Figure 10) clearly showed shoaling in the Authorized Channel, extension of the distal end of the northern lobe of the ebb shoal toward the southeast, and the attachment bar at R-47. The attachment bar was clearly moving to the south from somewhere between R-46 and R-47 in 2008 to R-47 in 2010.

Dredging the Federal channel. Dredging the authorized Federal channel would bisect the northern lobe of the ebb shoal and put the shoal into a geometry similar to the 1998 configuration (Figure 11). A large sand body that had been part of the northern lobe would remain south of the Federal channel. It would be expected that this sand body may attach to the southern lobe of the ebb shoal and move onshore in the attachment bar. It would also be expected that bypassing and the future evolution of the ebb shoal would be similar to that which occurred between 1998 and 2014.

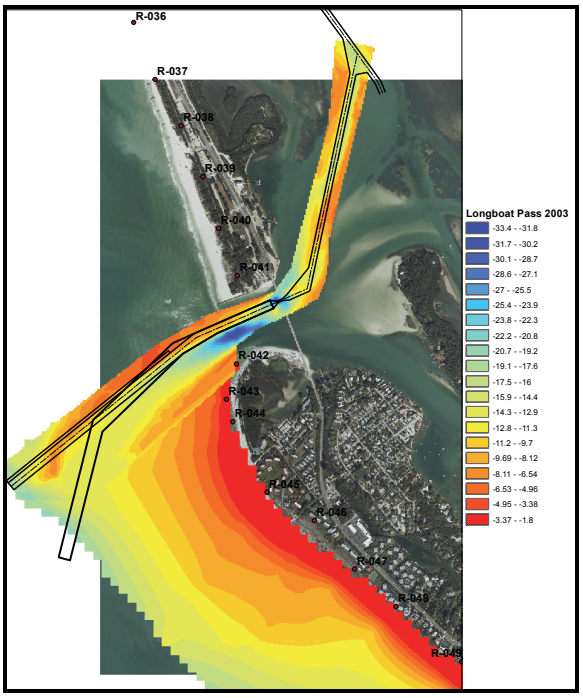

Figure 5. Longboat Pass ebb shoal bathymetry measured in 2003. Aerial taken in 2014. Authorized Channel (straight). Alternative channel (dog leg).

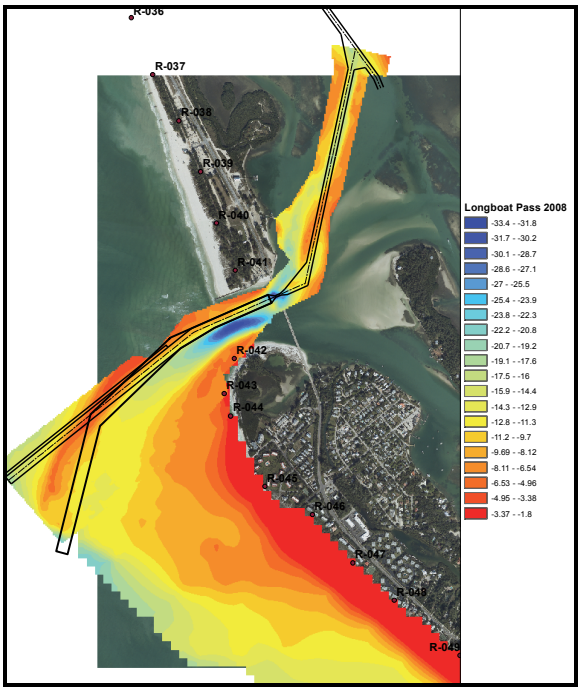

Figure 6. Longboat Pass ebb shoal bathymetry measured in 2008. Aerial taken in 2014. Authorized Channel (straight). Alternative channel (dog leg).

Dredging an alternative channel. An alternative dog-leg channel was evaluated because it more closely followed best navigable water in 2010. However, as of 2014, the north lobe of the ebb shoal has migrated into the template for this option. Depths along the crest of the ebb shoal generally range from approximately 2 to 5 ft, allowing the shoal to effectively reduce wave energy fronting Longboat Key. Removing this feature would open the northern end of Longboat Key to significantly increased wave energy, which could cause increased erosion along the shoreline

DISCUSSION: Whereas, in the previous decade, navigation was maintained by following best navigable water, as of 2014, there is consensus among stakeholders that it is best for navigation as well as for the reduction of erosion on the northern beaches of Longboat Key that the Authorized Channel be dredged. The sediment removed from the shoal will be placed beneficially on Longboat Key, with special emphasis on protecting the eroded beaches at the northern portion of the island. Investigation of the southwest Florida shoreline through the RSM program has revealed similar behavior among many passes in the region. Specifically, the tendency for the main ebb channel to realign to the south can cause negative impact to down-drift beaches such as those at Longboat and Siesta Keys (Figure 2).

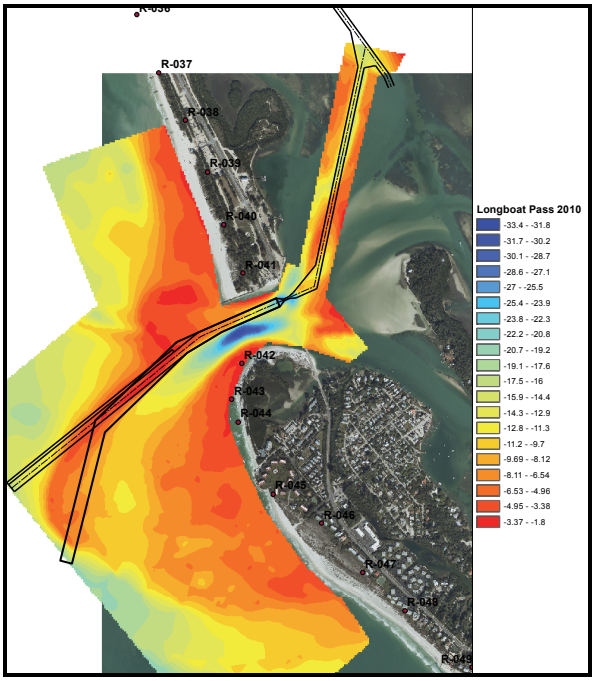

Figure 7. Longboat Pass ebb shoal bathymetry measured in 2010. Aerial taken in 2014. Authorized Channel (straight). Alternative channel (dog leg).

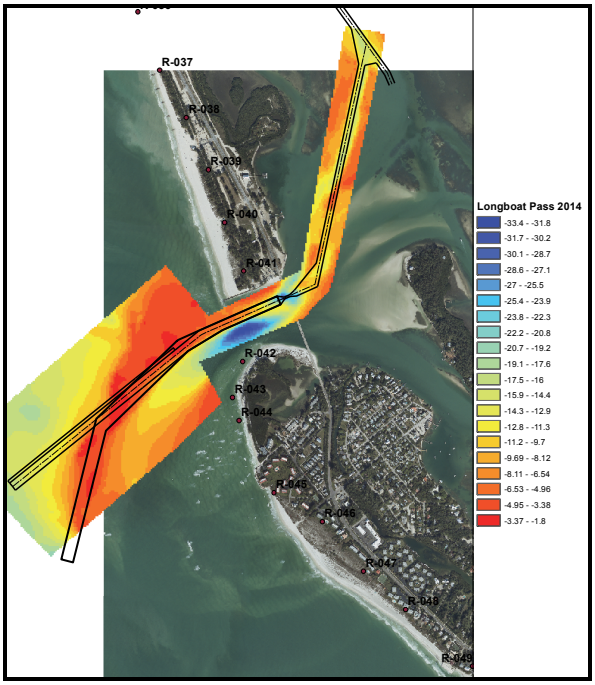

Figure 8. Longboat Pass ebb shoal bathymetry measured in 2014. Aerial taken in 2014. Authorized Channel (straight). Alternative channel (dog leg).

Additionally, it has been learned that the passes can behave as the source of sediments feeding the system if bypassing is efficient or as the sink for sediments if bypassing is inefficient. Management of sediment at the passes by mechanical bypassing is essential for passes that do not bypass sediment efficiently under natural conditions. Such is the case for Longboat Pass. As this Pass has not been maintained for navigation since 1997, the ebb shoal is in a configuration such that it is best to dredge the Pass along the Authorized Channel template. This configuration will serve to realign the channel into an east-west configuration and will provide sediment through beneficial placement to the severely eroded beaches at the northern extent of Longboat Key.

CONCLUSIONS: This CHETN documented the analysis of historical data and recent surveys of Longboat Pass to determine the best configuration of the Federal channel given the changing nature of the ebb shoal. After the removal of approximately 2 million yd^3 of sediment from the north lobe of the shoal in 1993, the main ebb channel rapidly realigned to the south, bypassing was re-established by 1998, and the ebb shoal was allowed to re-establish. Multiple surveys over the past decade have revealed the migration of the main ebb channel and the continued erosion at the northern portion of Longboat Key. As of 2014, the most distal portion of the north lobe of the ebb shoal has migrated south of the Authorized Channel template.

Given lessons learned from the southwest Florida RSM program, a determination was made to return to the original Authorized Channel configuration to maintain navigation and to use the mined sediment as beneficial use to reduce erosion on the northern portion of Longboat Key.

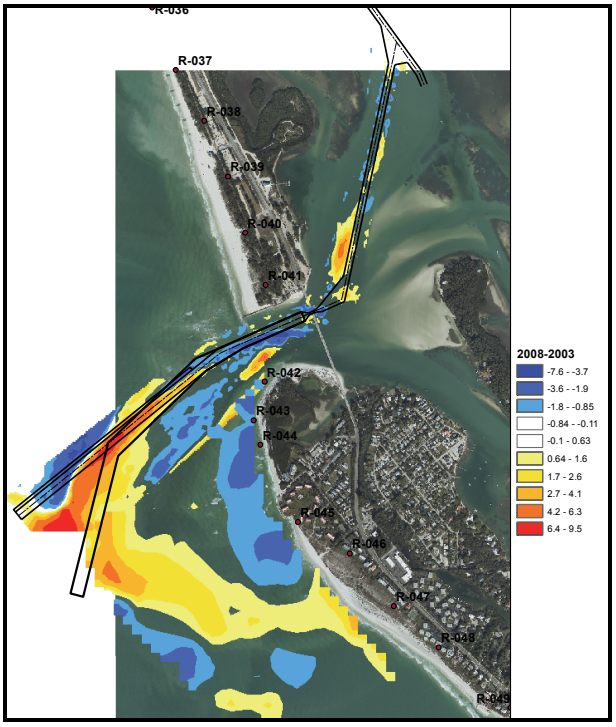

Figure 9. Difference in bathymetry between 2003 and 2008. Aerial taken in 2014. Authorized Channel (straight). Alternative channel (dog leg).

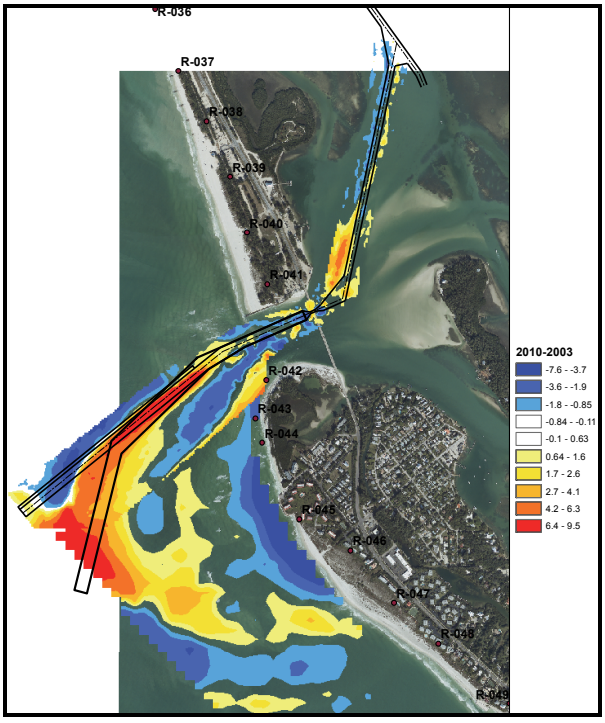

Figure 10. Difference in bathymetry between 2003 and 2010. Aerial taken in 2014. Authorized Channel (straight). Alternative channel (dog leg.)

ADDITIONAL INFORMATION: This Coastal and Hydraulics Engineering Technical Note (CHETN) was prepared by Kelly R. Legault, U.S. Army Engineer District, Jacksonville (SAJ). Funding for this study was provided by the USACE Regional Sediment Management (RSM) Program, a Navigation Research Development and Technology program administered by Headquarters, USACE. Additional information pertaining to the RSM Program can be found at the RSM website *http://rsm.usace.army.mil.*

Questions regarding this CHETN may be addressed to Kelly R. Legault (*Kelly.R.Legault@usace.army.mil*), SAJ Senior Coastal Engineer, Engineering Division. Additional information pertaining to the RSM program can be obtained from the USACE RSM Program Manager, Linda S. Lillycrop (*Linda.S.Lillycrop@usace.army.mil*).

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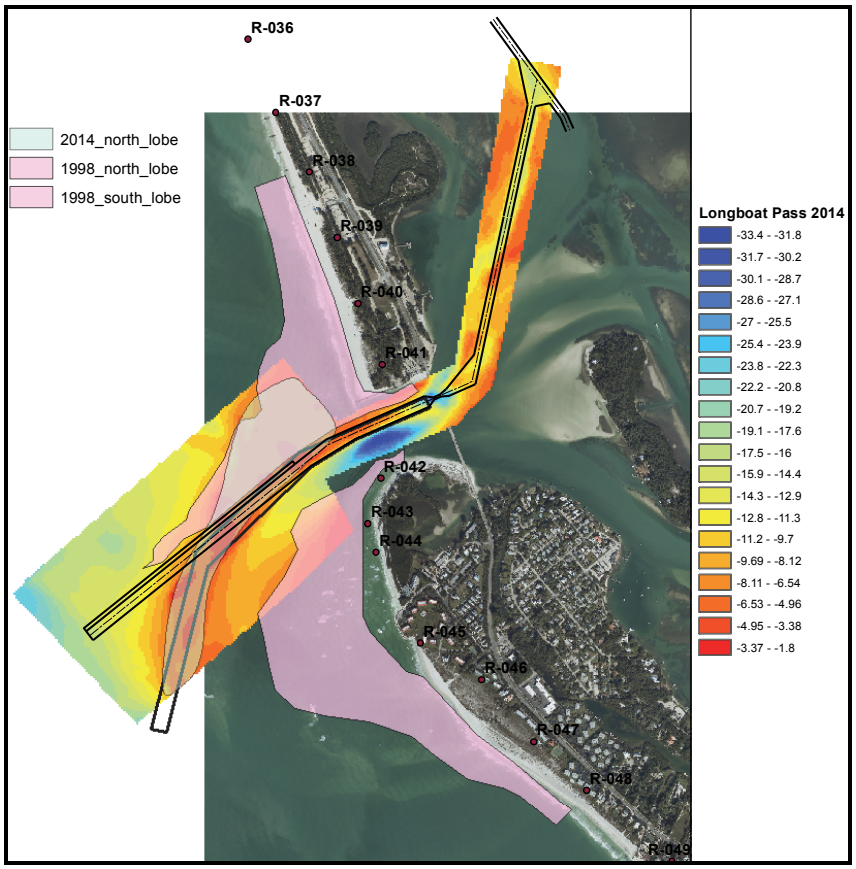

Figure 11. Longboat Pass ebb shoal planform in 1998 and 2014. Bathymetry obtained in 2014. Aerial taken in 2014. Authorized Channel (straight). Alternative channel (dog leg).

REFERENCES

Coastal Planning & Engineering, Inc. 2011. *Inlet management study of Longboat Pass and adjacent beaches.* Boca Raton, FL: Prepared for Manatee County and the Town of Longboat Key, FL.

FDEP. 2008. *Strategic beach management plan for the southwest Gulf Coast region.* Tallahassee, FL: Florida Department of Environmental Protection.

Humiston & Moore Engineers. 2008. *Regional model for Sarasota Bay and case studies of Longboat Pass and Venice Inle*t. Naples, FL: Prepared for West Coast Inland Navigation District, Venice, FL, and the Florida Department of Environmental Protection, Tallahassee, FL.

Manatee County. 2010. *Joint meeting, Manatee County Board of County Commissioners, and Longboat Key Town Commission, addressing Longboat Pass management plans*. Longboat Key, FL.

U.S. Army Corps of Engineers (USACE). 1975. *Detailed project report on Longboat Pass, Florida.* Jacksonville, FL: U.S. Army Corps of Engineers, Jacksonville District.